Patent Claims

1. A steering system for an agricultural or industrial utility vehicle, particularly for a tractor, an electric drive (22, 24) being provided for each half of an axle – preferably a front axle (20) -, which drive allows at least one wheel (26) associated with the respective half of the axle to be driven and which elective drive (22, 24) is controlled such that a defined torque can be transmitted from the electric drive (22, 24) to the wheel (26) it drives, with the wheels (14) associated with a mechanical drive axle – particularly a rear axle (12) – of the utility vehicle (10) being preferably driven by a mechanical drive (18, 18) of the utility vehicle (10), characterized in that the torque to be transmitted to a wheel on the outside of the bend is greater than the torque to be transmitted to the wheel on the inside of the bend in order to support or effect the steering of the utility vehicle (10).

2. A steering system according to claim 1, characterized in that the defined torque can be derived from the present operating state of the utility vehicle (10) and/or from operator input.

3. A steering system according to claim 2, characterized in that the present operating state of the utility vehicle (10) comprises a steering angle of a mechanical steering device (42) of the utility vehicle (10), the mechanical steering device (42) preferably comprising front axle steering.

4. A steering system according to claim 3, characterized in that the mechanical steering device (42) of the utility vehicle (10) is configured as an axle-pivot steering, a fifth wheel or articulated steering, with the present mechanical steering angle being preferably detected by means of a sensor (40).

5. A steering system according to any one of the claims 1 to 4, characterized in that a yaw rate sensor (38) is provided, which allows the yaw rate of the utility vehicle (10) to be detected, with the detected yaw rate being included in the torque computation.

6. A steering system according to claim 2, characterized in that an input device that can be operated by an operator of the utility vehicle (10) is provided, which allows a change of direction of the utility vehicle (10) to be defined or influenced.

7. A steering system according to claim 6, characterized in that the input device comprises a steering wheel (46), a joystick, a pedal or at least one switch (54) that is disposed on a steering wheel (46) of the utility vehicle (10).

8. A steering system according to any one of the claims 1 to 7, characterized in that the defined torque can be derived from a deviation of an actual driving direction from a desired driving direction of the utility vehicle (10).

9. A steering system according to claim 8, characterized in that the desired driving direction of the utility vehicle (10) can be derived based on a defined travel route, which is stored in a memory unit associated with the utility vehicle.

10. A steering system according to claim 8 or 9, characterized in that the desired driving direction can be derived based on signals from a navigation system, which are preferably transmitted remotely by at least one transmitter of the navigation system to the utility vehicle.

11. A steering system according to any one of the claims 1 to 10, characterized in that a remote control device is provided, which comprises at least one transmitter and one receiver (56) that is disposed on the utility vehicle, the remote control device allowing the utility vehicle (10) to be controlled remotely at least in part and allowing the input of a desired directional change of the utility vehicle (10).

12. A steering system according to any one of the claims 1 to 11, characterized in that an electric drive (22, 24) comprises at least one electric motor, which is preferably configured as an asynchronous motor, and in that preferably at least one reducing gear is provided between the electric motor and the associated wheel (26).

13. A steering system according to any one of the claims 1 to 12, characterized in that for each wheel (14, 26) a rotational speed sensor (34, 36) is provided, which detects the present rotational speed of the respective wheel (14, 26).

14. A steering system according to claim 13, characterized in that a rotational speed sensor (36) is provided directly or indirectly on an electric drive (22, 24).

15. A steering system according to claim 13 or 14, characterized in that the defined torque can be computed as a function of the detected rotational speeds of the individual wheels (14, 26).

16. A steering system according to any one of the claims 1 to 15, characterized in that the difference between the mean value of the peripheral speeds of the wheels (14) associated with the mechanical drive axle (12) of the utility vehicle (10) and the peripheral speed of the wheel (26) driven by the electric drive (22, 24) is taken into consideration in the computation of the torque to be transmitted by an electric drive (22, 24) of a wheel (26).

17. A steering system according to any one of the claims 1 to 16, characterized in that a limit of the torque to be transmitted to the wheel (26) is provided when a defined rotational speed threshold value of a wheel (14, 26) driven by an electric drive (22, 24) has been exceeded.

18. A steering system according to any one of the claims 1 to 17, characterized in that varying torque values are not defined for the wheels (26) driven by the electric drives (22, 24) until a defined value of a present operating state of the utility vehicle (10) has been exceeded and/or following operator input.

19. A steering system according to any one of the claims 1 to 18, characterized in that the electric drives (22, 24) are controlled in a non-linear fashion such that optimized tire wear is achieved in the case of large curve radii and/or that a minimal turning clearance circle diameter is achieved in the case of small curve radii.

20. A steering system according to any one of the claims 1 to 19, characterized in that a differential lock can be activated, which allows equal peripheral speeds of the wheels (26) driven by the electric drives (22, 24) to be generated.

21. A steering system according to any one of the claims 1 to 20, characterized in that a slight directional change of the utility vehicle (10) can be achieved merely by a defined torque difference of the electric drives (22, 24).

22. A steering system according to any one of the claims 1 to 21, characterized in that counter-steering of the utility vehicle (10) in response to a substantially constant extraneous cause that is applied on the utility vehicle (10) – for example travel parallel to a slope – can be achieved merely by activating the electric drives (22, 24).

23. A steering system according to any one of the claims 1 to 22, characterized in that the electric drives (22, 24) are controlled such that the utility vehicle can be stabilized.

24. A method for operating a steering system for an agricultural or industrial utility vehicle, particularly for a tractor, an electric drive (22, 24) being provided for each half of an axle – preferably a front axle (20) -, which drive allows at least one wheel (26) associated with the respective half of the axle to be driven and which elective drive (22, 24) is controlled such that a defined torque can be transmitted from the electric drive (22, 24) to the wheel (26) it drives, with the wheels (14) associated with a mechanical drive axle – particularly a rear axle (12) – of the utility vehicle (10) being driven by a mechanical drive (16, 18) of the utility vehicle (10) and with the method for operating a steering system according to any one of

the claims 1 to 23 being preferably employed, characterized in that the torque to be transmitted to a wheel on the outside of the bend is greater than the torque transmitted to the wheel on the inside of the bend in order to support or effect the steering of the utility vehicle (10).